

Solar Wind Ion Temperature Gradients as Observed by Ulysses at High latitudes

B E Goldstein (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109; 818-354-7366; bgoldstein@jplsp2.jpl.nasa.gov); M. Neugebauer (Jet Propulsion Laboratory, Pasadena, CA), S. J. Bame, D. J. McComas, and J. L. Phillips (Los Alamos National Laboratory, Los Alamos, NM 87545)

The Ulysses mission, because of the simplified structure of the solar wind at high latitudes during solar minimum, provides an excellent opportunity to study the evolution of the thermal ion distributions with distance from the Sun. Using data from the SWOOPS experiment, we have selected data greater than 45° from the heliographic equator (1.5 to 4.0 AU), with solar wind speed between 700 to 800 km/sec, and excluded transient events such as CMEs from the study. It is found that the proton temperature, T , scales with distance from the Sun as $r^{-0.48}$, the adiabatic invariant ($T^{1.5}/n$) as $r^{1.603}$, and density, n , as $r^{-1.674}$. The deviation of density from the expected inverse square law is presumably due to latitudinal or temporal gradients, and gives an idea of the uncertainty in the other two estimates. The ratio of alpha particle temperature to proton temperature increases with distance from the Sun as $r^{0.13}$, indicating a preferential heating of alpha particles. This could be due to either preferential turbulent heating, or resonant scattering from magnetosonic waves generated by alpha particle-proton streaming. Other aspects of the high latitude ion distributions such as temperature anisotropies will also be discussed.

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2. 01297525
3. (a) B E Goldstein
Jet Propulsion Lab,
169-506
4800 Oak Grove Dr.
Pasadena, CA 91109
(b) Tel 818-354-7366
(c) fax 818-354-8895
4. SH
5. a. SH01
b. 2164
Solar Wind Plasma
7. 0%
- 8.
9. C
10. None
11. No